APPENDIX 7-25

USFS INTERMOUNTAIN RESEARCH STATION PROPOSAL

RESEARCH PROPOSAL (29 April 1993)

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Intermountain Research Station
860 North 1200 East
Logan, Utah 84321

I. Title: Stream Channel Changes Associated with Room and Pillar Coal Mining, Blind Canyon, Utah.

II. Cooperators:

A. Genwal Coal Company
B. Utah Division of Oil, Gas, & Mining
C. Manti-LaSal National Forest
D. TerraTek
E. EarthFax
F. Intermountain Research Station, RWU-4301, Logan, UT

III. Objectives:

A. Quantify changes in stream channel profiles (both longitudinal and cross-sectional) related to subsidence following removal of underground coal pillars.

B. Quantify changes in channel features, including erosion, related to mining activities.

IV. Background:

Underground coal mining is often associated with adverse environmental impacts because of subsidence. Subsidence can cause loss of productive land (Guither, 1986), damage to underground pipelines (Hucka et al., 1986) and above-ground structures (Kaneshige, 1971), decreased stability of slopes and escarpments (Shea-Albin, 1992), and dewatering of streams and groundwater supplies (Coe and Stowe, 1984; Cifelli and Rauch, 1986). In the western U.S., deep coal reserves are mined by one of two underground methods: (1) room and pillar mining; and (2) longwall mining. Generally, greater depths of subsidence and faster rates occur with longwall mining compared to room and pillar. In the proposed investigation, room and pillar mining techniques will be used; however, after mining each cross-cut coal pillars will be removed during the "pull-back" phase of operations (R.J. Marshall, Genwal Coal Co., personal communication, 1993). Thus, subsidence will occur very quickly, similar to longwall mining.

No effects of underground mining on surface waters and stream channels have been documented in Utah. Changes in channel relief and morphology could affect water and sediment routing. Additionally, tension cracks that may develop could alter flow paths and interconnectivity of surface and groundwater. Answers to these questions are needed to assess the feasibility of mining under streams.

V. Site Characteristics:

The study area that will be undermined and subsided is in the upper reaches of Blind Canyon, an east-facing watershed that drains into Huntington Creek. The upper reaches of stream in Blind Canyon are likely not perennial. Estimated contributing area in the upper reaches of Blind Canyon (the portion which will be undermined) is 350 acres. Average channel gradient in the upper basin is 27%. Canyon sideslope gradients are typically 65%. Surface elevation within the upper basin ranges from 8720 to 10,743 feet. The channel reach within the subsidence zone is approximately 3660 feet in length and the surveyed reach will extend downstream another 1500 feet outside of the subsided area. This lower reach of unaffected channel is in the Manti-LaSal National Forest.

The Hiawatha coal seam is being extracted within the Blackhawk Formation at depths of 700 to 1600 feet below the surface of the streambed. This formation is composed of marine sedimentary rock, sands, and mudstones. The deepest extraction depths correspond to the upper reaches of the basin. Approximately 60 to 75% of the overburden at the Genwal Mine is sandstone deposited in relatively thick beds (Sinha, 1993). Coal pillars will be pulled in two cross cuts (oriented approximately parallel to the channel) that will cause subsidence in the Blind Canyon channel. Coal pillars in cross-cut 5L will be removed in May and June of 1993 and pillars in cross-cut 6L will be removed several months later. The removal of pillars in 5L will only subside a small portion of the channel located along a north-trending bend in the middle of the study area. This area will be surveyed prior to any subsidence (early June 1993). Projected subsidence along the streambed is approximately 35 inches (Sinha, 1993). Cross-cut 6L is directly under a large portion of the channel and thus will cause the greatest subsidence.

Additionally, a uncalibrated control channel in Crandall Canyon will be monitored throughout this study. Crandall Canyon is directly south of Blind Canyon and is very similar in geomorphic characteristics. Eventually, Genwal Coal Co. would like to undermine portions of Crandall Canyon, thus these data would serve as a baseline for future mining operations. Most reaches of channel in Crandall Canyon have perennial water.

VI. Methodology:

A. The following methods will be used to evaluate changes in channel profiles related to surface subsidence (Objective 1):

1. Establish 45 to 55 documented cross-sections along the study reach of Blind Canyon. These will be located an average of 100 to 150 feet apart (but not necessarily in regular interval spacing) to capture the spectrum of potential subsidence in the basin related to overburden depth differences. Cross-sections will extend outside (downstream) of the subsided zone. A similar set of documented cross-sections will be surveyed in the upper reaches of Crandall Canyon where future mining is planned. Channel cross-sections will be surveyed in detail with an engineer's level and the Company will reference endpoints of cross-sections to their permanent subsidence survey for both vertical and horizontal control. Channel changes at specific sites will be analyzed by a program to compute scour and fill (Noel and Sidle, 1989).

2. Longitudinal channel profile changes related to subsidence will determined by a thalweg survey in both drainages. Elevations will be measured at 10 m intervals and at all knickpoints or significant steps in the channel. Gradient changes due to subsidence would affect unit stream power and sediment transport, ultimately influencing channel morphology. The presence and dimensions of tension cracks in and adjacent to the channel will be documented on the thalweg survey and updated at each monitoring interval.

B. The following methods will be used to quantify changes in channel features related to mining activities:

1. Morphometric features will be surveyed along the entire length of the study reaches of both channels. Channel units will be classified in order of decreasing unit stream power as cascades, riffles, glides, and pools. Pools will further be classified by type (e.g., plunge pools, stream jet pools, meander pools, backwater pools, and submerged jet pools) and formation element (e.g., rock, woody debris, and bank failures). Residual volume of all pools will be measured. Any changes in channel features will be related to subsidence measurements (conducted by the Company) and channel cross-section changes.

2. A qualitative assessment of streambank stability for selected reaches of both channels will be conducted using methods similar to those outlined by Sidle et al. (1993). Photographs will be taken to support these assessments.

3. Pre-mining and post-mining landslides in Blind Canyon will be documented and described in detail. Air photos (provided annually by the Company) will aid in this assessment.

C. The following data will be supplied by the Company (or their contractors) to the Intermountain Research Station P.I.:

- -- rainfall data
- -- streamflow and seep or spring records
- -- subsidence maps
- -- predicted subsidence profiles along the channel
- -- topographic maps with cross-section end points
- -- air photos

VII. Project Personnel and Collaborators:

Intermountain Research Station Staff:

Roy C. Sidle, Supervisory Research Hydrologist, Principal Investigator
Bryan D. Williams, Senior Technician

Genwal Coal Company Staff:

R. Jay Marshall, Chief Engineer
Larry Johnson, Environmental Engineer

Manti-LaSal National Forest Staff:

Charles Jankiewicz, District Ranger, Price Ranger District

Utah Division of Oil, Gas & Mining Staff:

Sharon Falvey, Hydrologist

EarthFax Engineering Inc. Staff:

Brent K. Bovee, Geologist

TerraTek Staff:

Krishna P. Sinha, Geotechnical Engineer

VIII. Time Frame and Reporting:

The study to evaluate subsidence effects in Blind Canyon will begin on 24 May 1993 and is projected to end on 30 September 1995. The following field trips are planned to collect channel morphology data:

Early Summer 1993 (pre-subsidence data):
June 1-5: collect data in snow-free reach of Blind Canyon that will subside during pillar removal from cross-cut 5L.
June 24-July 2 (tentative): collect remaining data in Blind Canyon and Crandall Canyon.

Late September 1993 (8 days): early-stage subsidence data collection; Blind Canyon and Crandall Canyon (control).

Late June 1994 (8 days): post-subsidence data collection.

Late June 1995 (8 days): late-stage subsidence data.

An interim report will be prepared by the Intermountain Research Station by 1 September 1994 and a final report will be prepared by 30 September 1995. These reports will be distributed to Genwal Coal Co., Utah Div. of Oil, Gas & Mining, TerraTek, EarthFax, and the Manti-LaSal National Forest. Any changes in the overall study plan must be agreed to by both Genwal Coal Co. and the Intermountain Research Station Principal Investigator. Detailed technical papers on this research project will be published in appropriate scientific journals; the Company's contributions will be acknowledged.

IX. Environmental Stipulations:

All questions of NEPA compliance will be addressed by the Company and DOGM (State of Utah).

X. References:

Cifelli, R.C. and H.W. Rauch. 1986. Dewatering effects from selected underground coal mines in north-central West Virginia. Proc. 2nd Workshop on Surface Subsidence due to Underground Mining, pp. 249-263, Morgantown, WV.

Coe, C.J. and S.M. Stowe. 1984. Evaluating the impact of longwall coal mining on the hydrologic balance. 1984 Symp. on Surface Mining, Hydrology, Sedimentology, and Reclamation, pp. 395-403, Univ. of Kentucky, Lexington.

Guither, H.D. 1986. The mine subsidence threat to soils. J. Soil and Water Conserv. 41(1): 21-23.

Hucka, V.J., C.K. Blair, and E.P. Kimball. 1986. Mine subsidence effects on a pressurized natural gas pipeline. Mining Engineering 38: 980-984.

Kaneshige, O. 1971. The underground excavation to avoid subsidence damage to existing structures in Japan. **In:** Symp. Geol. and Geograph. Problems of Areas of High Population Density, pp. 169-199, Proc. Assoc. Eng. Geol., Sacramento, CA.

Noel, J.R. and R.C. Sidle. 1989. A program to calculate channel scour and fill. Water Resour. Bull. 25(4): 733-741.

Shea-Albin, V.R. 1992. Effects of longwall subsidence on escarpment stability. Proc. 3rd Subsidence workshop due to Underground Mining, pp. 272-279, Morgantown, WV.

Sidle, R.C., P.K.K. Terry, W.F. Mueggler, and B.D. Williams. 1993. Skyline Mine study: Hydrology and channel morphology changes related to surface subsidence. Interim Rep. No. 1 to Utah Fuel Co., Intermountain Res. Stn., Logan, UT, 31p.

Sinha, K.P. 1993. Subsidence prediction over Genwal Coal Mine - Huntington, Utah. Rep. #T93-53 to Genwal Coal Co., Terra Tek, Inc., Salt Lake City, UT, 22p.

Budget (According to Genwal Coal Company's Fiscal Year)

	Genwal Coal contribution	INT contribution
24 May 1993 - 1 July 1993		
Field Trip Expenses (2), including preparation:		
-- Salaries	$6821	$8656
-- Per diem	4125	----
-- Vehicle & travel expenses	523	425
Supplies	300	500
Administrative overhead (19%)	2236	----
SUB TOTAL (FY 1993)	$14005	$9581
1 July 1993 - 1 July 1994		
Field Trip Expenses (2), including preparation:		
-- Salaries	$7585	$8829
-- Per diem	5280	----
-- Vehicle & travel expenses	601	225
Data Analysis (salaries):	4220	9598
Travel (meetings/presentation of results):	----	1000
Supplies:	200	500
Computer costs:	500	500
Administrative Overhead (19%)	3493	----
SUB TOTAL (FY 1994)	$21879	$20652

1 July 1994 - 1 July 1995

Field Trip Expenses (1), including preparation:		
-- Salaries	$4022	$4680
-- Per diem	2856	----
-- Vehicle & travel expenses	438	200
Data Analysis (salaries):	3511	5213
Supplies:	200	200
Computer costs:	300	500
Report preparation:	1825	2340
Administrative Overhead (19%):	2499	----
SUB TOTAL (FY 1995)	$15651	$13133

1 July 1995 - 30 September 1995

Data Analysis (salaries):	$1900	$4170
Computer costs:	----	300
Final Report Preparation:	1825	----
Publication in scientific journals:	----	3120
Travel (meetings/presentation of results)	----	700
Administrative Overhead:	708	----
SUB TOTAL (late 1995)	$4433	$8290

TOTAL BUDGET (24 MAY 1993 to 30 SEPT. 1995):	**$55,968**	**$51,656**